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THE VALIDITY ISSUE IN
APPLIED GENERAL EQUILIBRIUM TAX MODELS

FELICITAS SCHARMER

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Adresse der Autorin:

Felicitas Scharmer
Institut für Finanzwissenschaft
Wirtschaftsuniversität Wien
Semperstraße 48
A-1180 Wien
1. Introduction

Structural supply oriented tax reforms that took place in many Western industrial economies during the past decade, e.g. in the United States of America, Great Britain, the Federal Republic of Germany, Sweden or Austria, put heavy challenge on the construction of econometric models. On one hand the magnitude of the fiscal changes made correct simulation increasingly difficult; on the other hand the decision-makers’ demand for empirical results experienced a shift from stability issues towards the welfare and efficiency effects of the proposed policy tools. Both trends gave rise to the development of a large number of applied general equilibrium (AGE-) tax models¹ which promised to overcome the weaknesses inherent with macroeconometric models by then used as a standard tool for policy evaluation.

Along with the refinement of the new evaluation instrument initial euphoria gave way to a more or less optimistic cautiousness among economists as what the models do and what they do not.² AGE-models have become subject to critique both on theoretical as well as on empirical grounds. Regarding theoretical aspects Tait (1989) has argued that suggestions from such work are suspect to the extent that the conditions imposed by the underlying neoclassical theory of general equilibrium do not hold in reality. Another group of economists, e.g. Kehoe and Levine (1990), have shown that overlapping-generations-models may not have determinate equilibria. Concerning empirical issues Harrison, Jones, Kimbell, and Wigle (1987) as well as Mansur and Whalley (1984) amongst others have stressed that the calibration of parameters to replicate benchmark equilibrium makes the robustness of results vulnerable to the choice of a few "key" behavioral parameters. Gottfried, Stöss, and Wiegard (1990) have contributed to further evidence on the influence of technical operations, mainly the choice of functional forms, on model results by use of a numerical equilibrium model for a fictive economy. Fullerton, Henderson, and Shoven (1984) discuss the strengths and weaknesses of different model structures for a survey of eight AGE-tax models of several countries.

The failure of US-tax models to give uniform policy recommendations provides a striking example against the validity of applied general equilibrium tax-models. Section 2 reviews the results of different AGE-models used to evaluate US tax policy. In section 3 methodological features are examined based on the procedure suggested by Fullerton, Henderson, and Shoven (1984) which shows that simulation results vary dramatically with the assumptions employed. In section 4 a final comment on the policy relevance of AGE-tax models is drawn.

² For a general comment on strengths and weaknesses of AGE-models see Borges (1986).
2. US-tax reforms and AGE-modelling

In order to study the contribution of AGE-exercise as a tool in tax policy analysis it is important to learn about the results that such models provide. US-tax models for two reasons offer an ideal playing field for a representative comparison. On one hand major tax reforms during the office of president Reagan contain a vast variety of topics for empirical research, on the other hand there already exists a number of highly sophisticated AGE-tax models based on US-economy-data.

The core features of the Economic Recovery Tax Act (ERTA) 1981 and the Tax Equity and Fiscal Responsibility Act (TEFRA) 1982 include a significant reduction of marginal rates of the individual income tax combined with savings and investment incentives, thereby relaxing the tax burden from both individuals and corporations. Moreover these reforms brought about massive changes in the tax structure. On an individual level the exemption of wide parts of capital income from the tax base introduced consumption-based elements into the existing income tax system. Analogously, on a corporate level the 1981 adoption of the Accelerated Cost Recovery System (ACRS) enabled the immediate deduction of investment expenditures from the tax base. Although some of these favorable provisions were modified by TEFRA 1982 the tax base was still shifted to some extent from corporate income to corporate cash-flow.

The Fairness Growth and Simplicity Tax Act (Tax Reform Act, TRA) 1986 in contrast aimed a revenue neutral shift in the tax burden from individuals to corporations. Investment incentives were diminished (in case of the ACRS) or fully repealed (in case of the investment tax credit, ITC) and a statutory minimum tax rate was introduced, partly being compensated by a general reduction of corporate income tax rates from 46% to 34%. The individual income tax experienced a significant reduction of both marginal tax rates and the number of income brackets on one hand and the repeal of tax exemptions and deductions on the other hand. Tax-cut-cum-base-broadening removed the expenditure-tax-elements from both the individual and the corporate income tax drawing the tax structure near the concept of a comprehensive income tax system.

The simulation of welfare and allocation effects of different tax designs make up the main topic of AGE-tax models. However, many AGE-models aim to shed light on hypothetic questions of tax theory, e.g. the overall impacts of a consumption tax regime. Consequently, in this chapter only simulation results will be reviewed that are based on actual tax reform measures respectively rejected reform proposals. This compilation can by no means be comprehensive but it is still sufficient to point out the relevance of AGE-models by the practical examples of ERTA 1981, TEFRA 1982 and TRA 1986:
On a corporate level the introduction of ACRS 1981 results in long run welfare gains\(^3\) of 0.29\% - 0.34\% of GNP (Fullerton, Henderson, 1985, p 370); by the same time steady-state capital-stock increases by between 2\% (Fullerton, Henderson, 1985, p 370) and 12.4\% (Summers, 1987, p 87). The amendments by TEFRA 1982 show somewhat lower welfare gains of 0.22\% - 0.29\% of GNP (Fullerton, Henderson, 1985, p 370).

The repeal of the ITC by the 1986 tax reform leads to welfare losses of 0.57\% - 0.59\% of GNP (Bovenberg, Goulder, 1989, appx tab 5). Slowing down rates of net investment cause the steady-state capital-stock to lower by between 5.22\% (Bovenberg, Goulder, 1989, appx tab 4) and 11.61\% (Goulder, Summers, 1986, appx tab 5); however, the long-run percentage change of the capital stock is dampened by the simultaneous reduction of the corporate income tax rate; additional means of investment finance are set free which ceteris paribus tend to increase the capital stock by 2.86\%, leaving a net overall decline of the steady-state capital stock of 8.02\% (Goulder, Summers, 1986, appx tab 5).

In contrast, a potential repeal of the corporate income tax by integrating it into the individual income tax would have lead to either welfare losses of 0.007\% of GNP (Fullerton, Gordon, 1983, p 407) or welfare gains up to 1.39\% of GNP (Ballard, Fullerton, Shoven, Whalley, 1985, p 162). Allowing for international capital mobility would even double the welfare gains up to 2.84\% of GNP (Ballard, Fullerton, Shoven, Whalley, 1985, p 229). Partial integration by means of a dividend deduction from the corporate income tax would have shown welfare gains of between 0.38\% and 0.52\% of GNP (Ballard, Fullerton, Shoven, Whalley, 1985, p 162); partial integration by allowing a dividend deduction from the individual income tax ("dividend gross up") would have resulted in welfare gains of between 0.32\% and 0.36\% of GNP (Ballard, Fullerton, Shoven, Whalley, 1985, p 162).

On an individual level the 1981 savings incentives shifting the tax base partly from individual income to consumption help to increase consumers' welfare by 0.56\% - 0.6\% of GNP (Ballard, Fullerton, Shoven, Whalley, 1985, p 178); these gains would have been exceeded by the potential welfare gains from a pure consumption tax, reaching from 1.15\% to 1.24\% of GNP (Ballard, Fullerton, Shoven, Whalley, 1985, p 178); however, by considering international capital mobility a consumption tax within the same model surprisingly exhibits welfare losses of 0.58\% - 1.22\% of GNP (Ballard, Fullerton, Shoven, Whalley, 1985, p 223); in an alternative setting a consumption tax would lead to welfare gains of 0.29\% - 2.32\% of GNP (Auerbach, Kotlikoff, 1987, p 77). In contrast, taxing comprehensive income as partly aimed by TRA 1986 would reduce consumers' welfare by 0.9\% - 1.09\% of GNP (Ballard, Fullerton, Shoven, Whalley, 1985, p 178).

\(^3\) Welfare effects are usually expressed as the sums of consumers' equivalent variations (EV) as a percentage of National Income or GNP.
3. Models and methodologies

Applied general equilibrium analysis involves the evaluation of policy options by use of a general equilibrium model incorporating data of real economies. The theoretical framework of the model is based on the Walrasian general equilibrium structure. Models therefore contain at least a household sector and a production sector. Consumers possess an initial factor endowment and maximize utility according to their budget-constraints. Production factors are used in production in a profit-maximizing combination. For the evaluation of tax policy the prototypical model must be at least extended by a government sector collecting taxes and redistributing revenues in some way. General equilibrium is reached at a set of relative prices where demand equals supply for all commodities and factors. The solution of the general equilibrium system is carried out by computer algorithms. On the empirical side the basic data and functional parameters have to be adjusted exogenously by the model builder such as to replicate benchmark equilibrium. The policy change can then be specified and a new counterfactual equilibrium is calculated. The policy option is evaluated by comparing the counterfactual equilibrium to the benchmark solution. Dynamic models in addition solve for a dynamic adjustment path both with and without the policy change under investigation. Thereby they do not only allow for a comparison between long run steady-state equilibria but also between the periods of transition.

Dynamic AGE-models employed for US-tax policy evaluation can be roughly classified into three broad categories according to the degree of consumer foresight and the determination of consumer lifetime: first, models with static expectations and infinite time horizon, second, models with perfect foresight and infinite time horizon, and third, models with perfect foresight and finite time horizon.4

- Static expectations and an infinite time horizon imply that a sequence of static equilibria is calculated based on households' intratemporal choice between current and future consumption, the latter being enabled by current saving. Comparative-statics are relaxed by the periodical increase of the initially fixed capital stock by the amount of pre-period savings/investment. The major advantage of myopic expectations-models turns out to be the high disaggregation of both the consumer- and the producer side.

- The adoption of perfect consumer foresight allows the computation of a dynamic adjustment path converging to steady state equilibrium. Households' utility optimization is based on intertemporal consumption/savings decisions. Producers' investment decisions are in this setting usually driven by an intertemporal maximization of the value of the firm. Neoclassical restrictions of

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4 For a detailed documentation of a choice of US-models according to 19 key features see Scharmer (1991), pp 67.
perfect factor mobility are often released by the introduction of adjustment costs for new investment.

- Models with finite time horizon usually differ from the ones with infinite time horizon in disaggregating the household sector into overlapping generations. The adoption of an individual's life-cycle of n years allows the simultaneous consideration of n age-cohorts in each time period. Consumers' intertemporal consumption/savings-decision in the overlapping generations (OLG-) models is based on life-cycle hypothesis. Comparing the work with varying degree of consumer foresight a trade-off becomes obvious between either the adoption of consistent expectations or the richness in disaggregation of household- and firm sectors.

Different methodological structures prove to make an enormous impact on simulation results. The quantitative deviations between the results of different models by far exceed the sensitivity of results to behavioral parameters within models. Unfortunately, the implications of structural and ad-hoc-assumptions incorporated in a certain AGE-setting are not obvious to the user of model results. As a second best procedure, Fullerton, Henderson, and Shoven (1984, p 368) suggest to compare the key features of AGE-models employed for evaluating similar reforms. Thereby divergences between simulation results can be traced back to alternative methodological qualifications. For a choice of eight AGE-tax models published worldwide until 1983 they found published results determined largely by the following methodological issues: disaggregation, specification of the foreign sector, financial modeling, the measurement of effective tax rates, heterogeneity and imperfect factor mobility, factor supply and the treatment of the government budget (Fullerton, Henderson, Shoven, 1984, pp 377).

When comparing the structure and the quantitative results of recent US-tax models some of these issues can be validated. Others cannot be evaluated without conducting sensitivity-analyses with the relevant model. However, as models become more sophisticated new critical assumptions are adopted that may alter the magnitude or even reverse the sign of the reported effects. In particular, the adjustment of taxes under the condition of equal yield, the foreign sector specification, the degree of consumer foresight, investment finance, and the level of disaggregation prove to exert significant influence on the results and hence on the validity of AGE-tax-models. Each of these assumptions may of course become relevant for the validity of any

5 These include the measurement of effective tax rates and financial modeling. Regarding the effective tax rates Fullerton, Henderson, and Shoven (1984, pp 388) point out the validity issues of applying average corporate tax rates to marginal investments. In fact, the removal of the corporate income tax causes welfare gains in a model that assumes equity financed investment to be distorted by the corporate income tax (Ballard, Fullerton, Shoven, Whalley, 1985, p 162). Welfare losses are exhibited in a model assuming that, with full loss offset, corporate tax payments are only a compensation to government for accepting a fraction of the investment risk (Fullerton, Gordon, 1983, p 407).

With respect to companies' financial behavior Fullerton, Shoven, and Whalley (1984, pp 366) as well as Whalley (1988, p 33) stress the need to capture tax distortions in the choice between debt and equity finance. These inefficiencies are for example incorporated in the models by Fullerton, and Gordon (1983) and Galper, Lucke, and Toder (1988). Assuming fixed proportions of debt and equity capital all other models underestimate the gains from corporate tax integration. This validity problem arises because the removal of the bias towards debt finance, and thus the decrease in the social costs of the leverage risk, are omitted.
empirical model, regardless its theoretical foundation. In the following section the above mentioned methodological issues are illustrated with an application to US-tax policy appraisal by different types of AGE-models.

Equal-yield tax reform

In order to meet the requirements of a Walrasian equilibrium not only the private households but also the government must satisfy their budget constraints. Government expenditures are usually held constant in real terms, thus providing for a constant utility level in public consumption. The remaining possibility for balancing the government budget is to lower or raise tax revenues in order to satisfy the condition of equal yield. In current US-tax-models the adoption of lump-sum taxes and value-added taxes or the adjustment of personal income tax rates have been applied to balance the government budget.

An AGE-setting therefore is appropriate for the simulation of equal yield-tax reforms, where revenue losses of one tax are compensated for by additional revenues of another tax. For example, tax-cut-cum-base-broadening in company taxation by TRA 1986 should be offset by the net relief of private households. In contrast, severe validity problems can arise when evaluating tax reforms with net changes in tax revenues, e. g. the overall relief of the tax burden of both individuals and corporations brought about by ERTA 1981. For the interpretation of latter model results it is most essential to survey the kind of tax having been adjusted because different taxes generate different efficiency effects.

Behaving neutral under efficiency aspects lump-sum taxes have the disadvantage of not being a realistic alternative for modern tax systems. Nevertheless, the adoption of a lump-sum tax remains the best choice for modeling tax reforms with an overall change in the tax burden of individuals and corporations. The allocative efficiency of such tax reforms can only be evaluated correctly when the resulting revenue changes are compensated for by adjusting a non-distorting tax, i.e. a lump-sum-tax.

Raising any other tax in contrast generates new inefficiencies, while lowering a distorting tax diminishes existing inefficiencies. A general value added-tax influences real household incomes and thus distorts labor supply. An income tax furthermore acts as a disincentive in regard of households' savings. Therefore any welfare changes calculated by the underlying model are due to the real tax reform on one hand and the adjustment of a distorting tax merely to satisfy the condition of equal yield on the other hand. Methodological problems arise because the allocative efficiency of the tax reform can no longer be isolated from the aggregate effect.
Foreign Sector Specification

Endogenizing a foreign sector in AGE-tax-models has already been stressed as critical in simulating switches between origin-based taxes and destination-based taxes (Fullerton, Henderson, Shoven, 1984, p 386). However, any national tax policy measure affects relative prices between the domestic economy and foreign countries. Given international mobility of goods and factors tax reforms thus lead to shifts in resource allocation between open economies. Therefore the specification of a foreign sector should not be restricted to the evaluation of origin/destination-based taxes. Considering international movements of goods and factors is essential when evaluating major tax changes other than in a closed economy. Some current US-tax-models allow for such adjustments, including trade flows or physical factor movements. Monetary flows of international reserves have yet been ignored in the models revisited here.

Sensitivity analyses conducted by Ballard, Fullerton, Shoven, and Whalley (1985, p 223) with varying degrees of openness show that results react little sensitive when allowing for alternative specifications of international trade. Capturing flows of capital services or direct investments, however, changes model results significantly. The main reason for this phenomenon is that capital exports decrease domestic welfare because the domestic economy would only receive the net-of-tax rate of return to capital whereas the foreign economies would gain the gross-of-tax product of capital, and vice versa (Fullerton, Henderson, Shoven, 1984, p 386). The largest impact as compared to the base-case version of the Ballard, Fullerton, Shoven, and Whalley approach (1985, p 223) occurs when evaluating a consumption tax, where originally reported welfare gains disappear under the assumption of international capital mobility. First of all, the consumption tax offers reasonable savings incentives. The existing "classical" corporate tax system, however, makes it rational for US-households rather to invest abroad in order to avoid the double taxation of corporate profits. Welfare gains from the increase of the capital stock thus accrue to the foreign economy. Depending on the values of the interest elasticity of households' savings the adoption of a consumption tax may lead to domestic welfare losses. Obviously, the intertemporal efficiency gains of the consumption tax are outweighed by the distortions in capital allocation between the domestic and the foreign economy. In contrast, the welfare gains from the integration of the corporate and the individual income tax double under the assumption of international capital mobility. Due to the higher US-net-of-tax rate of returns to capital foreign capital is attracted, thus further augmenting domestic capital stock and domestic welfare. The same argument can be stated for the evaluation of investment incentives. The introduction of accelerated depreciation or tax credits attracts both domestic and foreign capital. Welfare gains primarily accrue to domestic households. Repealing investment incentives deteriorates welfare. However, a small part of the welfare losses can be shifted to foreign capital-owners.
Therefore models assuming a closed economy tend to overestimate the welfare changes from tax reforms that lead to capital-outflows and ignore the gains from capital-inflows. Evidence shows that the estimated effects are sometimes opposite in sign to those from the full specification of a foreign sector model.

Expectations

Both the assumption of myopic expectations and perfect foresight invalidates the expected welfare effects from tax reforms that cause changes in capital supply or capital demand. Moreover, model results are largely influenced by either formulation.

Simulations carried out by Ballard and Goulder (1985) point out that model results vary systematically with the degree of consumer foresight. Evaluating the adoption of a consumption tax under different degrees of foresight they found out that additional foresight can lead to lower welfare (Ballard, Goulder, 1985, pp 272 - 275). This is brought about by the influence that expectations exert on households' savings. The savings incentives created by a consumption tax raise the overall capital supply and thus lower the relative price of capital. Households with myopic expectations react to current changes in the return to capital in the subsequent period. Therefore households save more in the subsequent period than they would have saved had they correctly anticipated the subsequent decline in the rate of return. Households with perfect foresight in contrast do not overestimate future returns. This explains why they save less in each period as compared to the households with myopic expectations. Lower savings under the assumption of perfect foresight cause the capital stock to grow at a slower rate which in turn causes lower welfare gains.

The argument stated by Ballard and Goulder (1985) can be applied to any tax reform that changes the relative price of capital and thus affects households' savings. In general the welfare effects caused by changes in capital supply prove to be much higher under the assumption of myopic expectations than under perfect foresight. The integration of the individual and the corporate income tax, for example, has the same consequences with regard to households' savings as a consumption tax. The repeal of the corporate income tax leaves unchanged before-tax profits but increases after-tax-rates of return thus working as a savings incentive. As in the case of the consumption tax the increase in capital supply makes the relative price of capital decline. In myopic expectations models, e. g. Ballard, Fullerton, Shoven, and Whalley (1985, p 178) consumers tend to overestimate future returns to capital. Consequently, myopia leads to higher saving by consumers, and capital deepening proceeds more quickly. Under such circumstances
the expected welfare gains from the removal of the corporate income tax are higher than under
the assumption of perfect foresight.

Serious validity problems also arise when simulating tax reforms that cause changes in capital
demand, as for example investment incentives. In this case expected welfare gains or losses are
higher the greater the degree of foresight becomes. The introduction of an ACRS or an ITC
augments capital demand thus raising the relative price of capital. In a myopic expectations model
households cannot correctly anticipate higher current rates of return to capital and therefore save
less than households with perfect foresight. Steady-state capital stock and welfare gains from
investment incentives are therefore low under the assumption of myopic expectations, as for
example in the Fullerton, and Henderson (1985) framework. The perfect foresight approach, e. g.
Summers (1987), in contrast exhibits large welfare improvements from the introduction of the
ACRS. Analogously, the welfare losses from the repeal of investment incentives are substantial in
perfect foresight models, e. g. Bovenberg and Goulder (1989) as well as Goulder and Summers
(1986). As households expect future rates-of-return to fall they save even less which causes the
capital stock to diminish at a faster rate, thus causing higher welfare losses than in a myopic
expectations model.

Investment Finance

The simulation of company taxation proves to be influenced significantly by the specification of the
marginal source of finance. In some models marginal investment is financed by constant average
proportions of debt and equity. In others new share issues or retained earnings represent the
marginal source of finance.

Alternative specifications of investment finance differ in two main aspects. These are the available
means of finance and the cost of capital. The available means of finance that a company can raise
affect the maximum level of investment. From this point of view the companies whose source of
finance is restricted to retained earnings achieve the lowest level of investment. On the other
hand, the costs of capital affect the rentability of marginal investments. Tax systems usually favor
debt finance by allowing the deduction of interest payments from the tax base. The effective cost
of debt capital therefore equals the interest rate because both the marginal return to capital and
the marginal cost of capital are cut down by the corporate income tax rate. In contrast, equity
finance is biased as the marginal cost of equity capital cannot be offset against corporate tax
payments. With regard to both the available means of finance and the cost of capital mixed
debt/equity finance is therefore superior to pure equity finance. Within the latter new share issues
represent a more favorable source of investment than retained after-tax profits.
Companies which finance their marginal investment out of retained earnings depend to a larger degree on investment provisions. Therefore they react more sensitive to the adoption or the repeal of investment incentives as compared to those companies that own the possibility of debt finance or new share issues. This explains why the capital accumulation as a result of the ACRS 1981 is four times higher in a model with retained earnings (Summers, 1987, p 87) than calculated under the assumption of debt/equity finance (Fullerton, Henderson, 1985, p 370). The repeal of the ITC 1986 on the other hand causes roughly a double decline of the capital stock under the assumption of retained earnings (Goulder, Summers, 1986, tab 5) as compared to models with new share issues (Bovenberg, Goulder, 1989, tab 4, 6 and Eichengreen, Goulder, 1988, tab VI.2). Expected changes in the capital stock thus are not only due to the underlying change in company taxation but to a great extent to the source of marginal finance.

Disaggregation

As Fullerton, Henderson, and Shoven (1984, p 378) point out disaggregating the production sector refines the estimates of company taxation. However, they implicitly consider as justified that the 1983 version of the "Auerbach/Kotlikoff model, designed to evaluate taxes on consumption and labor income, has no disaggregation of production" (Fullerton, Henderson, Shoven, 1984, p 377). Concentrating on intertemporal efficiency effects and the redistribution of the tax burden between working and retired generations Auerbach and Kotlikoff (1987) have yet ignored intersectoral misallocations.

Although the consumption tax primarily affects the savings/consumption decision of private households, its possible feedbacks on the ressource allocation between industries should not be neglected. Ballard, Fullerton, Shoven, and Whalley (1985, p 184) show that the relative price of capital decreases when shifting the tax base from income to consumption. This is mainly due to a permanent increase in capital supply by private households that save more under the consumption tax regime than they would have had the income tax been maintained. As the decrease in the relative price of capital accrues to all industries intersectoral differences in the cost of capital diminish. In consequence, capital allocates more evenly between industries, thereby causing intersectoral efficiency gains. By assuming only one representative firm these gains from a consumption tax cannot be covered by the model. Therefore the welfare gains exhibited by Auerbach and Kotlikoff (1987, pp 75, 77) would have been even higher by disaggregating the production sector.

The quantity and the sign of estimated welfare effects are determined by the tax distortions captured by alternative model specifications. As prices adjust endogenously in an AGE-framework
tax changes are allowed to spread to other sectors within the model that had not been primarily affected by the tax reform. Disaggregating the production sector therefore should not be restricted to the evaluation of company taxation.

4. Summary and Policy Implications

The eventual user of any empirical model is the decision-making government. In considering the results from an AGE-model it is essential for the user to understand how the calculations are carried out, the assumptions on which they are based, and the qualifications that surround them.

The aim of this paper was to determine the implications of alternative specifications of AGE-tax models. By concentrating on methodological considerations, in particular, two other empirical issues have been omitted in this paper: first, the construction of a micro-consistent data base and, second, the selection of parameter values.

The crucial point with regard to the data base is that the available informations from input-output tables and other sources do not meet the conditions for Walrasian equilibrium. Therefore a number of adjustments to the data become necessary, as for example described in detail in Ballard, Fullerton, Shoven, and Whalley (1985), amongst others. The consequence after all these adjustments is that the model can no longer describe the real economy under investigation. Rather, the simulations of policy options show how the economy would behave had it ever been in general equilibrium. Even though this fact diminishes the policy relevance of AGE-models the issue has been hardly addressed in the literature. Moreover, all but one of the US-tax models reviewed here lack a documentation of the data sets. Further research in the direction of the robustness of model results to the construction of the data base is therefore desirable and necessary.

In contrast, the procedure mainly used to select parameter values has been addressed a major weakness of AGE-models. The specification of parameter values (calibration) involves two steps. In the first step particular values for key parameters are chosen from available econometric estimates or other sources. In the second step all other functional parameters are uniquely identified such as to reproduce the benchmark equilibrium. The calibration procedure is therefore merely deterministic which may seem troublesome to econometricians. Probably because of this awareness model builders usually conduct sensitivity analyses to check out how robust the results are to alternative parameter values. Substantial progress in different methods of systematic sensitivity analysis has been made in work by Pagan, and Shannon (1985), Harrison, Jones, Kimble, and Wigle (1987) as well as Harrison, and Vinod (1992). By reviewing US-tax models it became clear, surprisingly, that parameter issues are of minor importance with regard to the policy
relevance of AGE-tax models. Sensitivity analyses published in the models under investigation show that the rough quantitative dimension and the sign of the results remain largely unchanged. The deviations between the results of different models used to evaluate similar reforms prove to be substantially higher than the deviations within one model. The choice of parameter values therefore can only explain a small part of the variation between model results.

By examining the results of US-tax models two main points with regard to policy relevance become obvious. First, the results from AGE-models diverge extremely in a quantitative as well as in a qualitative dimension due to the underlying assumptions. Apart from very few exceptions, model constructors usually do not publish sensitivity analyses with regard to the main structural characteristics of the model. It is therefore impossible for the user to assess how a variation of the assumptions would change the outcome. Second, concentration on long run allocational issues fades out distributional and stability aspects of tax reforms. AGE-models thus run the risk of being misused by supply-oriented lobbies as a scientific justification for their policy proposals. Model constructors should therefore intend their research rather as a contribution to the academic debate than as a tool to facilitate the assessment of policy changes.

Unfortunately, general equilibrium models despite their imperfections can neither be substituted for by partial equilibrium models nor by Keynesian macro-models. Nevertheless, just because you walk in the desert does not mean that there is promise land.
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